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(51) [illegible]

Комитет Российской Федерации
по патентам и товарным знакам

(12) ОПИСАНИЕ ИЗОБРЕТЕНИЯ

к патенту Российской Федерации

1

(21) [illegible]
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(71) [illegible]
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(73) [illegible]
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(54) СПОСОБ ОЧИСТКИ СТОЧНЫХ ВОД ОТ ИОНОВ МЕТАЛЛОВ

(57) [illegible]

[illegible] ... может быть использовано при [illegible] слоев гальванических [illegible] цветной металлургии, а также для очистки растворов от [illegible] металлов. [illegible]

[illegible] является [illegible]

[illegible]

Ультрадисперсный порошок алюминия, полученный методом электрического взрыва проводников в среде [illegible] с размером частиц 0,23 мкм в количестве 200; 500; 800 мг/л вносят в реактор, наполненный водой, перемешивают [illegible] на 0,5 часа. Затем отделяют [illegible]. Определяют остаточное содержание металлов в воде. [illegible] определяют [illegible] индикаторов. [illegible]

Результаты [illegible] табл. 1.

Как видно из табл. 1 [illegible]

[illegible]

ства 200-500 мг/л. Предложенный способ прост в исполнении, не требует дополнительных операций по установлению pH воды и обработке химреактивами. Отсутствие этих операций упрощает способ очистки сточных вод от ионов металлов и снижает затраты на очистку воды от ионов металлов по сравнению с прототипом.

Таблица 1

Образец	Исходные концентрации металлов в воде, мг/л				Кол-во мг/л	Остаточные концентрации загрязнений, мг/л			
	Cr	Pb	Th	Sr	Al	Cr	Pb	Th	Sr
1	1.00	10.00	5.00	5.00	150	0.80	7.00	0.00	1.00
2	1.00	10.00	5.00	5.00	180	0.10	2.05	0.00	0.10
3	1.00	10.00	5.00	5.00	200	0.01	0.10	0.00	0.01
4	1.00	10.00	5.00	5.00	300	0.00	0.05	0.00	0.00
5	1.00	10.00	5.00	5.00	350	0.00	0.00	0.00	0.00
6	1.00	10.00	5.00	5.00	500	0.00	0.00	0.00	0.00
7	1.00	10.00	5.00	5.00	600	0.00	0.00	0.00	0.00
8	1.00	10.00	5.00	5.00	700	0.00	0.00	0.00	0.00

Таблица 2

Образец	Исходные концентрации металлов в воде, мг/л				Кол-во реагента, мг/л	Остаточные концентрации загрязнений, мг/л			
	Cr	Pb	Th	Sr	Fe	Cr	Pb	Th	Sr
1	1.00	10.00	5.00	5.00	150	0.70	8.00	1.00	1.00
2	1.00	10.00	5.00	5.00	190	0.09	2.00	0.00	1.00
3	1.00	10.00	5.00	5.00	200	0.00	0.10	0.00	0.00
4	1.00	10.00	5.00	5.00	300	0.00	0.04	0.01	0.00
5	1.00	10.00	5.00	5.00	350	0.00	0.00	0.00	0.01
6	1.00	10.00	5.00	5.00	500	0.00	0.00	0.00	0.00
7	1.00	10.00	5.00	5.00	600	0.00	0.00	0.00	0.00
8	1.00	10.00	5.00	5.00	700	0.00	0.00	0.00	0.00

Таблица 3

Образец	Исходные концентрации ионов в воде, мг/л				Реагент, мг/л	Остаточные концентрации загрязнений, мг/л			
	Cr	Pb	Th	Sr	Al + Fe	Cr	Pb	Th	Sr
1	1.00	10.00	5.00	5.00	150	0.05	0.75	0.85	1.12
2	1.00	10.00	5.00	5.00	180	0.12	2.30	0.08	0.15
3	1.00	10.00	5.00	5.00	200	0.01	0.10	0.02	0.04
4	1.00	10.00	5.00	5.00	300	0.00	0.05	0.00	0.02
5	1.00	10.00	5.00	5.00	350	0.00	0.00	0.00	0.01
6	1.00	10.00	5.00	5.00	500	0.00	0.00	0.00	0.00
7	1.00	10.00	5.00	5.00	600	0.00	0.00	0.00	0.00
8	1.00	10.00	5.00	5.00	700	0.00	0.00	0.00	0.00

Формула изобретения

СПОСОБ ОЧИСТКИ СТОЧНЫХ ВОД ОТ ИОНОВ МЕТАЛЛОВ, включающий обработку реагентом, перемешивание и отделение осадка, отличающийся тем, что, с целью упрощения процесса очистки, в качестве реагента используют ультрадисперсные порошки алюминия и/или железа, полученные электрическим взрывом проводников, в количестве 200 - 500 мг/л.

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Committee of the Russian Federation
on Patents and Trademarks

(12) **DESCRIPTION OF THE INVENTION**

for Patent of the Russian Federation

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(53) Inventor's Certificate, USSR No. 778,181, cl. C 02 F 1/62, 1983.

(54) METHOD FOR REMOVING METAL IONS FROM WASTEWATER

(57) Used to remove ions of heavy and radioactive metals from wastewater. Essence of the invention: wastewater is treated with ultradispersed powder of aluminum and/or iron produced by electrical explosion of a conductor. The powder is added to the wastewater in an amount of 200 to 500 mg/liter, mixed, and removed after 0.5 hour. The method can also be used to extract such metals as lead, thorium, and strontium from wastewater. 3 tables.

The invention relates to a method for removing ions of heavy and radioactive metals from wastewater and it may be used to purify wastewater at electroplating and nonferrous metallurgy plants and to remove radioactive metal ions from solutions.

Most similar in technical essence to the proposed method is a method for removing heavy metal ions from wastewater in which effluent containing zinc, copper, nickel, hexavalent and trivalent chromium ions is treated, the heavy metals are converted to their oxides, and the precipitates are removed. The problem with this method is its complexity, since when the heavy metal ions are removed by converting them to insoluble hydroxide ions, the ions of various heavy metals are converted to hydroxides most completely at various pH values. Thus, it is impossible to select a pH range in which the heavy metal ions would be completely converted into hydroxides. Consequently, it is necessary to work within a certain pH range and also to add ferrous hydroxide in an amount of 50-250 mg/liter with reference to iron. After the metal hydroxides are removed from the water undergoing treatment, the water must be neutralized to a certain pH. The ferrous hydroxide used in this method is unstable in air and requires special storage conditions (N. S. Akhmetov, Neorganicheskaya khimiya, Moscow, Vyshaya shkola, 1975, p. 624).

The object of this invention is to simplify the process of removing metal ions from wastewater.

This object is achieved in that in the method for removing metal ions from wastewater, including treatment of the wastewater with a metal-containing

reagent and subsequent removal of the precipitate, ultradispersed powders of aluminum and/or iron obtained by electrical explosion of conductors, in quantities of 200-500 mg/liter, are used as the precipitating reagent. Purification is carried out at any desired pH in the range ≥ 3. The required pH of the water is determined by the chemical processes occurring among the aluminum, iron, and water.

The method is implemented in the following manner.

Example. Wastewater containing chromium, thorium, and strontium ions at a concentration of 100 MPC was treated. The water was treated in a 10 m^3 reactor. Ultradispersed aluminum powder produced by electrical explosion of a conductor in an argon environment with a particle size of 0.23 μm in amounts of 200, 350, and 500 mg/liter was pumped into a reactor filled with water, mixed, and allowed to stand 0.5 hour. The precipitate was then removed by settling. The residual metal-ion content in the water was determined. Radioactive metals were determined by using radioactive indicators. Heavy metals were detected by photocolorimetry (Fizikokhemicheskiye metody analiza [Physicochemical Methods of Analysis], Leningrad, Khimiya, 1974, p. 89).

The results are presented in Table 1.

As seen in Table 1, treatment produces practically complete removal of the metal ions from the water when aluminum is added in an amount of 200-500 mg/liter. If less than 200 mg/liter aluminum is added, then the water is

not sufficiently purified and the metal ions exceed the MPC. No more than 500 mg/liter should be added, since the water is already purified at 500 mg/liter.

Table 2 presents results from a study in which metal ions were removed from water by dispersed iron powder with a particle size of 0.15 μm

As seen in Table 2, treatment produces practically complete removal of the metal ions from the water when iron is added in an amount of 200-500 mg. No more than 500 mg/liter should be added. If less than 200 mg/liter aluminum is added, then the water is not sufficiently purified of metal ions.

If a mixture of aluminum and iron powders is used as the metal-containing reagent, then the ions are removed just as they are when aluminum and iron powders are used separately. The results are presented in Table 3.

As seen in Table 3, treatment produces practically complete removal of the metal ions from the water when reagent is added in an amount of 200-500 mg. In this case, the powder contains aluminum and iron in equal parts. If less than 200 mg/liter aluminum is added, then the water is not sufficiently purified of metal ions. No more than 500 mg/liter reagent should be added, since the water is already purified of metal ions at 500 mg/liter.

Thus, when water containing both heavy metals (Cr, Pb) and radioactive metals (Th, Sr) is treated, the metal ions are practically completely removed if the reagent is added in amounts of 200 to 500 mg/liter. The proposed method is simple to use and requires no additional operations to set the pH or to process the solution with chemical reagents. The absence of these operations simplifies

the method of removing metal ions from water and reduces the cost of water purification, compared to the prototype [prior art].

Table 1.

Sample	Initial concentrations of metals in the water, mg/liter				Quantity, mg/liter	Residual concentrations of contaminants, mg/liter			
	Cr	Pb	Th	Sr	Fe	Cr	Pb	Th	Sr
1	1.00	10.00	5.00	5.00	150	0.80	7.00	0.90	1.00
2	1.00	10.00	5.00	5.00	180	0.10	2.05	0.09	0.40
3	1.00	10.00	5.00	5.00	200	0.01	0.10	0.03	0.04
4	1.00	10.00	5.00	5.00	300	0.00	0.05	0.01	0.02
5	1.00	10.00	5.00	5.00	350	0.00	0.00	0.00	0.01
6	1.00	10.00	5.00	5.00	500	0.00	0.00	0.00	0.00
7	1.00	10.00	5.00	5.00	600	0.00	0.00	0 00	0.00
8	1.00	10.00	5.00	5.00	700	0.00	0.00	0 00	0.00

Table 2.

Sample	Initial concentrations of metals in the water, mg/liter				Quantity, mg/liter	Residual concentrations of contaminants, mg/liter			
	Cr	Pb	Th	Sr	Al	Cr	Pb	Th	Sr
1	1.00	10.00	5.00	5.00	150	0.70	8.00	1 02	1.10
2	1.00	10.00	5.00	5.00	180	0.09	2.90	0 08	1.00
3	1.00	10.00	5.00	5.00	200	0.00	0.10	0 04	0.04
4	1.00	10.00	5.00	5.00	300	0.00	0.04	0 01	0.02
5	1.00	10.00	5.00	5.00	350	0.00	0.00	0.00	0.01
6	1.00	10.00	5.00	5.00	500	0.00	0.00	0 00	0.00
7	1.00	10.00	5.00	5.00	600	0.00	0.00	0 00	0.00
8	1.00	10.00	5.00	5.00	700	0.00	0.00	0 00	0.00

Table 3

Sample	Initial concentrations of ions in the water, mg/liter				Quantity, mg/liter	Residual concentrations of contaminants, mg/liter			
	Cr	Pb	Th	Sr	Al + Fe	Cr	Pb	Th	Sr
1	1 00	10.00	5.00	5.00	150	0 06	0.75	0.85	1.12
2	1 00	10.00	5.00	5.00	180	0 12	2.30	0.08	0.15
3	1 00	10.00	5.00	5.00	200	0 01	0.10	0.02	0.04
4	1 00	10.00	5.00	5.00	300	0 00	0.05	0.00	0.02
5	1 00	10.00	5.00	5.00	350	0.00	0.00	0.00	0.01
6	1.00	10.00	5.00	5.00	500	0 00	0.00	0.00	0.00
7	1.00	10.00	5.00	5.00	600	0.00	0.00	0.00	0.00
8	1.00	10.00	5.00	5.00	700	0 00	0.00	0.00	0.00

Claim

A MEANS OF REMOVING HEAVY METAL IONS FROM WASTEWATER, including treatment with a reagent, mixing, and removal of the precipitate, wherein, in order to simplify the purification process, the reagent used is an ultradispersed powder of aluminum and/or iron produced by electrical explosion of wires, used in an amount of 200 to 500 mg/liter.

[Printing information is given at the bottom of the page—Trans. note.]